energieke restauratie

Energy efficient Restoration International Conference

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QSEM: Quick Scan Energy

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Background

When the church was no longer in use for religious activities the former municipality Borger bought and renovated the church so it could be used for the councils' meetings. Therefore some interventions were done: most of the interior was removed, with an exception of the historic organ; a new floor with a floor-heating system was installed, supplemented with a number of radiators. These radiators were placed in niches that where carved out in the thick walls, right underneath the windows. To improve the accessibility of the church an underground hallway between the town hall and the church hall was built. Toilets and installations were located underground next to the town hall. **(Figure 1)**

After uniting the municipalities of Borger and of Odoorn (into Borger-Odoorn), a new town hall was built in Exloo, so the town hall and church became vacant. From then on the church hall was used on an irregular basis for activities of the local community. This changed when the owner of 'Van Slag: platform of art & culture' became interested in using this church for his enterprise. The municipality was very pleased with his plan, so he rented the building and modified the interior. In the autumn of 2012 the church was reopened and today his business runs above expectation.

BUT..... The renter of the buildings quickly understood why the municipality was so enthusiastic about finding a renter: the energy costs were very high! And more important for the renter: no matter how much gas he burned, the visitors were complaining about thermal comfort. Meanwhile, another organisation showed interest in buying the church, allowing the current renter to use the building. But they were only interested if they were provided with recommendations to reduce the energy costs. (Figure 2)

Here our research started. While Maarten was working on his approach for reducing energy consumption in historic buildings, the province of Drenthe asked me, as a consultant for heritage buildings, to provide them with recommendations to reduce energy costs in the former church of Borger.

Approach

The Dutch Heritage Act protects the church of Borger. The exterior and the tower are both valued with national importance; the interior (with an exception for organ and organ corridor) has lower to none heritage qualities. We started our research with the perspective that, although we relate energy use to buildings, energy consumption is the result of human activities, as we have preferences for a specific thermal comfort. Therefore activities, thermal comfort and complaints are important aspects of our approach and research.

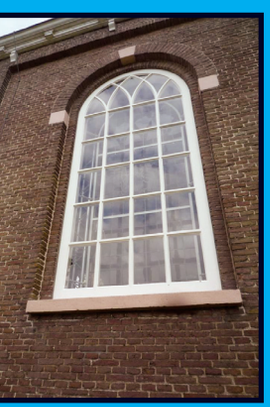
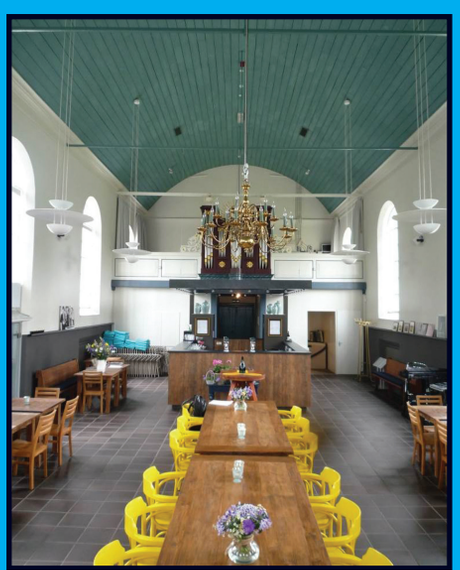


Figure 1 Exterior Borgers' church



Interior after renovation (Annemarie de Groot, 2013) **Figure 2**

efficient Monument

An energetic balance in raising thermal comfort and reducing energy consumption in Borgers'church

The research was done in three steps:

- *Inventory of the building*
    - The technical condition
    - Explaining what causes energy consumption (heat loss, materials, installations)
- *Inventory of the use of the building*
    - The type and frequency of the activities
    - User preferences (thermal comfort, future demands, current complaints)
- *Developing scenarios for reducing energy consumption*

We collected data by assessing the building during a visit, and also used data provided by the renter of the building (use of the building and type of installations). Since it was only a quick scan, no in depth calculations on heat loss and energy consumption were done.

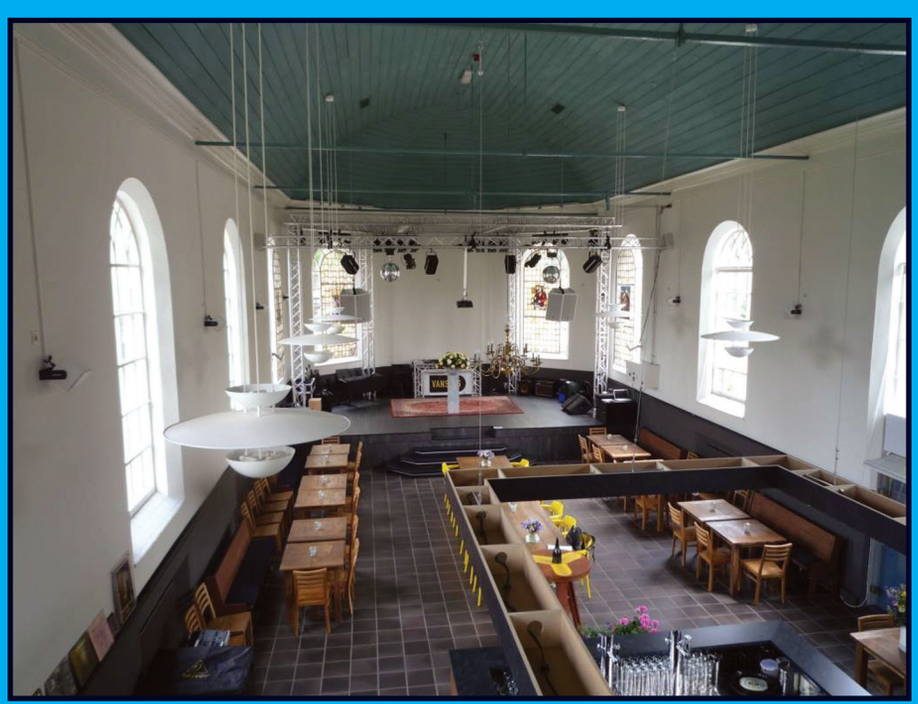
Results

Inventory of the building

The technical condition of the building and installations is good. Also different installations are present to provide in the user demands: a heating system (floor heating and radiators), a boiler, and a lighting and sound installation.
It is expected that heat is lost through the wooden ceiling, single glass windows, radiator niches, the publicly accessible underground hallway (for fire safety), and by the cracks around doors. Also the heating system may not be efficient for the current use. A floor heating system is sufficient for regular use with about the same number of users, while in the current situation the use is infrequent and the amount of visitors varies. The adjacent radiators should provide for the peaks of thermal comfort demands. But the heating system might work inefficient because some radiators are placed behind the stage and the distance for transporting hot water is long (through the underground hallway, about 40 meters) . The use of electricity is primarily influenced by the lighting and sound installation. It was also found that the boiler works 24/7, but is not used much. **(Figure 3)**

Inventory of the use of the building

The building is used for several types of activities such as concerts, meetings and catering by a varying amount of visitors (25-250). Also the activities take place on an irregular basis, for example not frequent during weekends, and more frequent during the evening and afternoon.
At this moment the operating expenses, and specifically energy costs, form a problem for the continuity of the use. Also, visitors complain about the thermal comfort. The renter added that heating the church is not a problem, but cooling down the church is. More practical demands are the addition of a terrace and shortening the distance to the toilets and storage (without using staircases).



Inventory of the building and installations (Annemarie de Groot, 2013) **Figure 3**

Developing scenarios for reducing energy consumption

With all the collected data, we made a range of energy measures that could be implemented in four scenarios **(see Figure 4)**. So the owner can choose to implement one of more scenarios when the time is right (or the money available).

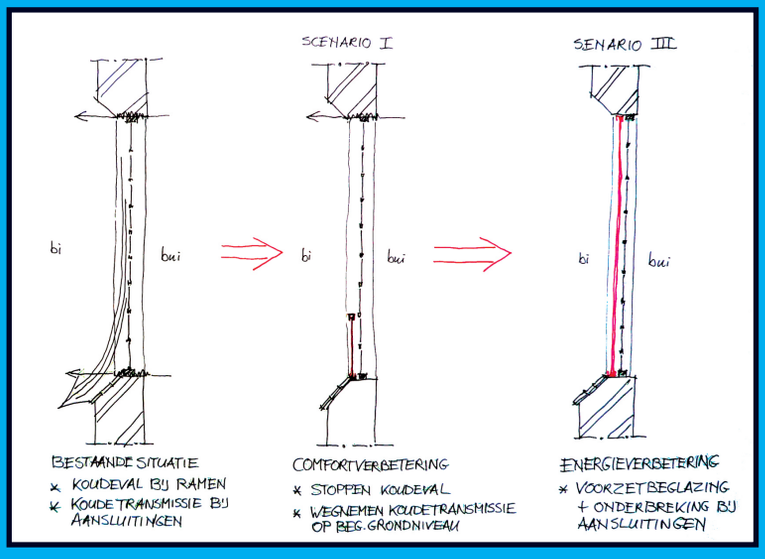
- Easy-to-apply measures to improve thermal comfort: heat or physical curtain to the entry of the underground hallway, adding an extra door in the hallway to the (cold) tower, crack sealing, replace the boiler for a kettle, using blankets for smaller (more personal) activities and monitoring the energy consumption to find out whether the building and energy management could be done more efficient.
- Minor modifications to the building and installations: improving the efficiency of the existing situation by placing insulation behind the radiators, stop using radiators behind the stage and using a more easy control system for heating.
- Major interventions to the building and installations: applying a cooling system, heat recovery in a ventilation system, adding an enclosed entrance area, build an extension for toilets and storage which may also be used for a heating system (shortening the distance of heat transport).
- Energy and the environment: generating energy by using solar panels (which may also be an awning or canopy for a terrace, generating energy by a wood pallet heating system, using rest heat from neighbours for the floor heating system. When choosing for an energy measure that involves other organisations, the owner of the church will become a participant, which is another role than a client (the economic risks and legal aspects may raise complexity of the decision-making process).

Impact of the results and discussion

The results of our research were presented to the province of Drenthe and an energy consultant was asked to make calculations on the recommended strategies in the quick scan. The consultant advised to take into account the majority of suggestions from strategy I) and II). Furthermore, he suggested the BaOpt system as an alternative to the current heating system, which could reduce energy consumption and raise thermal comfort. Together with the current owner (the municipality), the interested 'new' owner and the National Heritage Agency, the concrete plans are worked out. What is the impact of bringing in a new type of (heat and CO) controlled ventilation system to the heritage qualities of the monumental church? Or is this impact acceptable weighing the advantages for the use (thermal comfort and operating expenses)?

Evaluation of the approach

In this quick scan we tried to balance thermal comfort with a reduction of energy use and with the preservation of heritage qualities. The urgency for the quick scan was because of high operating expenses. To improve the QSEM-approach the technical and financial feasibility of potential energy measures should be studied. But first the owner and municipal government must agree on the legitimacy of implementing energy measures (the urgency for the owner) and on what energy measures are acceptable (weighing heritage qualities and the user value).



Sketches of alternative scenarios for improving the heating system and the windows. **Figure 4**